Badger Meter Europa GmbH

MoniSonic 4900

User manual

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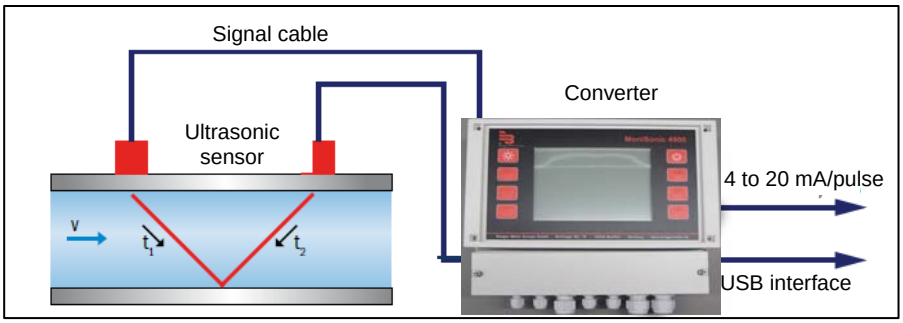
1. Principle of measurement



The MoniSonic 4900 uses the highly precise ultrasonic transit-time measuring principle, for which two ultrasonic sensors are externally mounted on the pipeline and connected with the electronic. The ultrasonic sensors alternately work as transmitter and receiver and mutually send ultrasonic signals. During these transmissions, the respective signal transit times of the to-and-from signals (t1, t2) are measured. The electronic of the MoniSonic 4900 measures the difference of the transit time of the ultrasonic signals going with and against the direction of flow t1 and t2. These signals are either decelerated or accelerated by the medium flow. The difference produced in both signal transit times is proportional to the flow rate and will be used together with the pipeline geometry for a precise flow calculation.

2. MoniSonic 4900 and components

Illustration 1: MoniSonic 4900 – Mounted ultrasonic sensors (below) and converter

Your MoniSonic 4900 mainly consists of the ultrasonic sensors mounted on your pipeline system and of a converter.

2.1 Converter

The converter ensures the signal processing and makes the measurement results available to the user.

2.2 Ultrasonic sensors

The ultrasonic sensors are externally mounted on the pipeline and both produce and receive the ultrasonic signals by which the flow recorded through the converter can be determined.

Ultrasonic sensor XUC-FW20 (2 MHz), colour of housing: RED, for pipe diameters DN10…DN100, temperatures: -40°C…150°C

Ultrasonic sensor XUC-FW10 (1 MHz), colour of housing: BLUE, for pipe diameters: DN32…DN400, temperatures: -40°C…150°C

Ultrasonic sensor XUC-FW05 (0.5 MHz), colour of housing:GREEN, for pipe diameters DN200…DN6000, temperatures: -40°C…80°C (150°C optional)

2.3 Interface

MoniSonic 4900
Badger Meter Europa
Help: For a fast Setup of the basic parameters, choose QUICK SETUP else choose COMPL. SETUP
Setup Ch1
COMPL. SETUP
Setup Channel 1
QUICK SETUP
XDCR dist = 184,0 mm
BAR index = 13
MEAS.
CH2
Badger Meter Europa GmbH · Nürtinger Str. 76 · 72639 Neuffen · Germany · www.badgermeter.de
Connecting terminals for ultrasonic sensors
Connecting terminals for PT100 and input/output
Supply terminals

Terminals for the ultrasonic sensors:
Please connect your ultrasonic sensors here. Connect the upstream sensor by using the terminal with the inscription „UP“ and connect the downstream sensor by using the terminal with the inscription „DOWN”. If these two connections are mixed up, the flow rate or the flow will be indicated with the negative sign.

Terminals for PT100 and input/output:
If you intend to use your MoniSonic 4900 as a heat meter, then connect the PT100 (three-wire-system) here. The PT100 has 3 leads in white (WH), white (WH), and red (RD). Please connect them to the corresponding terminals.

The standard analogue output 1 (OUT 1, 4-20mA) as well as the relay of the MoniSonic 4900 are fed. Please take into account that these outputs are active, and therefore alive.

The terminals allow connecting cables within the range of 0.2-1.5mm^2.

Power supply:
Please feed either 230VAC or 24VDC according to the respective version of your device.

2.4 Safety instructions

⚠ The operating temperatures of the converter should not exceed or fall below a temperature range of -20°C up to 60°C!

The ultrasonic sensors are susceptible to shocks and vibrations. Therefore, please ensure that the sensors are neither exposed to strong vibrations nor to intense mechanical shocks. The sensors may already be destroyed beyond repair after one single unintentional drop!

The power supply unit should only be used indoors!

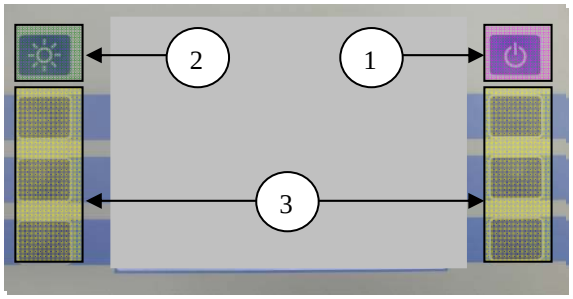
Replace the power supply unit or the 230V mains cable completely in case of a mechanical or electrical damage!

Instructions for the operation in ATEX explosion-proof zones:
The converter and the standard ultrasonic sensors are not suitable for use in explosion-proof zones!

Do not use the ultrasonic sensors above or below the permissible medium temperature range!

3. Operation

3.1 Control keys



1	Without function.
2	Switches the background lighting on and off.
3	Multifunctional keys: Select the function which is indicated on the adjacent screen by means of the respective key.

3.2 Basic operation/navigation

Please use the multifunctional keys:

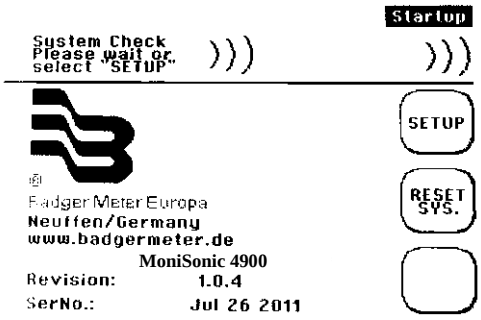
▲ ▼ ◀ ▶	Direction keys for navigation
ENTER	Acknowledges the entry
NEXT	Acknowledges the entry and switches to the next window
BACK	Back to the previous window
+	Increases the value
−	Reduces the value
XYZ	Releases the XYZ function (variable function according to the respective application)
	Without function

4. Initial start

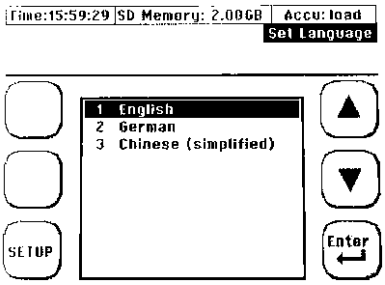
4.1 Basic setting, navigation to the main menu

4.1.1 Adjusting the display language

1. Switch on the meter and push the multifunctional key beside the field „SETUP LANG.“



2. Select the respective language within the appearing window by means of he arrow keys. Acknowledge your entry with the „Enter“ key.

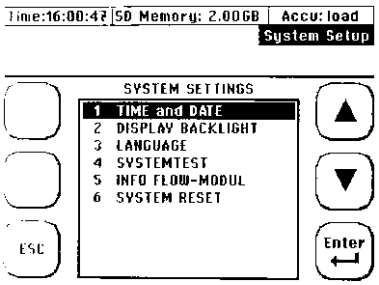


⚠ You can alter the language within the menus by adjusting the language. The language within the fields beside the multifunctional keys, however, will remain unchanged.

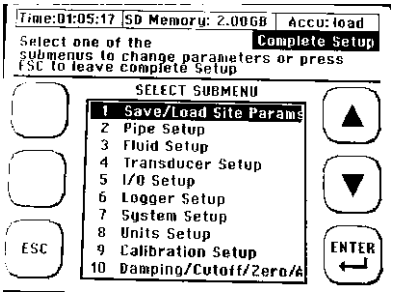
4.1.2 Adjusting the time and date

After having selected your language, you are now in the main menu of the meter.

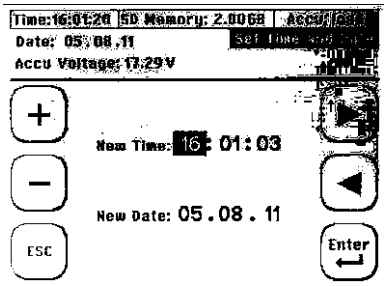
1. Now, select „System setting“ by means of the arrow keys.



2. Then, select „Time and date“



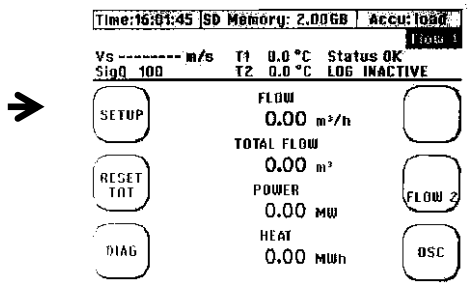
3. Enter the time by using the format hour (hh) : minute (mm) : second (ss). Then, enter the date by using the format day (dd) : month (mm) : year (yy).



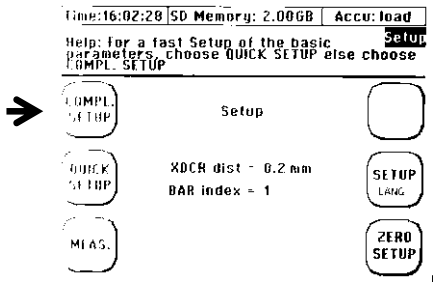
4.1.3 Navigation to the main menu

After having switched on your MoniSonic 4900 and the display of the start screen, the measurement window “Flow 1” will appear automatically after a few seconds.
The measurement window „Flow 1“ shows an overview of all necessary information for the flow and for the heat quantity measurement.

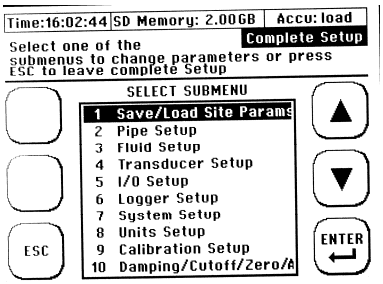
1. Now, select „Setup“



2. When you see this window, select „CMPL. Setup“.



3. You are now in the main menu from which you can select all necessary functions of your device.



4. In order to return to the measurement window, press „ESC“ and „MEAS“ in the subsequent window.

Now, you know the basic operations of your MoniSonic 4900.

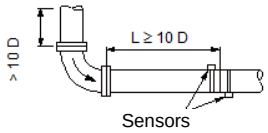
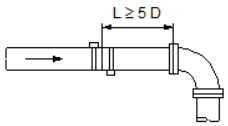
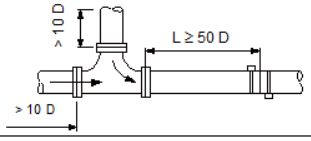
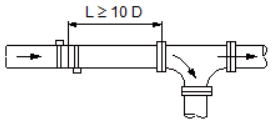
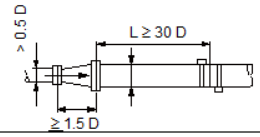
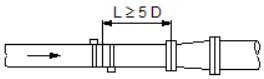
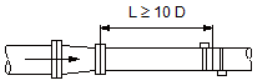
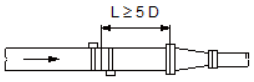
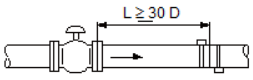
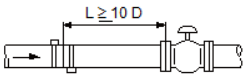
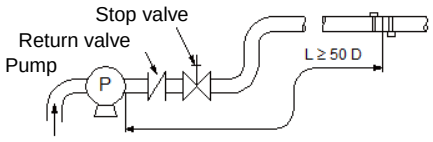
To reach the main menu more quickly after having switched on the meter, select „SETUP“ already during the start sequence and „COMPL. SETUP“ in the next window.

5. Preparation of the measurement

Please take into consideration the following aspects to ensure a successful flow measurement.

5.1 Inlet and outlet distances

The place, where the meter is mounted, will have a considerable influence on the measurement quality. Especially, the inlet and outlet distances should be taken into account. Therefore, see the following table:

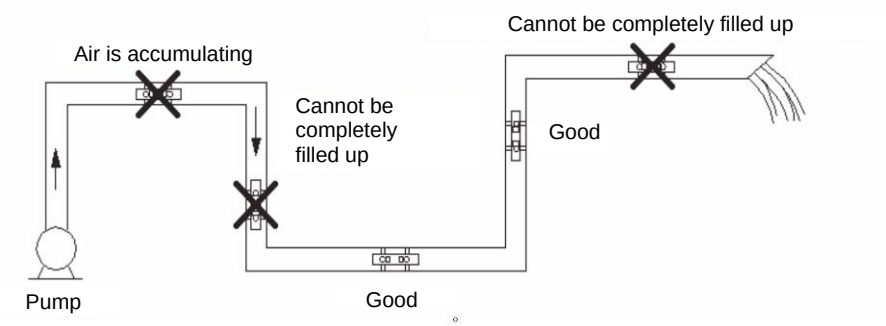
Partitioning	Upstream	Downstream
90° bend		
T-piece		
Enlarge-ment		
Reduc-tion		
Valves	 Upstream control valve	 Downstream control valve
Pump		

5.2 Mounting positions of the ultrasonic sensors

5.2.1 General information on the installation of the ultrasonic sensors

At the mounting position, the pipe must always be completely filled up (pressure pipe)!
Measurements on only partially filled pipes are not possible!

The ultrasonic sensors can be mounted vertically, horizontally or in any other position. It is, however, indispensable to observe the possible mounting positions mentioned below:



The illustration shows the side view of the pipeline.

5.2.2 Installation of the ultrasonic sensor on horizontal pipelines

In case of an horizontal pipeline, we recommend to install the sensor approx. +/-45% offset the horizontal plane surface, because it might be possible that bubbles will form in the upper part of the pipeline and sediments in the lower part.

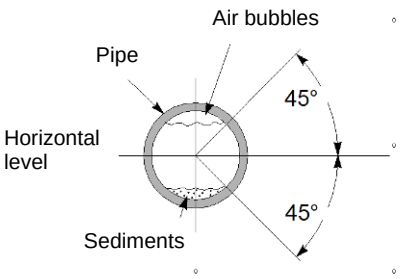


Illustration 2: Installation of the ultrasonic sensors – positioning (1)

5.2.3 Ultrasonic sensors on uneven surfaces

Avoid the installation of the ultrasonic sensors on uneven surfaces like weldings or deformations. Try as far as possible to remove thick and uneven protective coatings of paint from the pipe locations on which you intend to install your ultrasonic sensors.

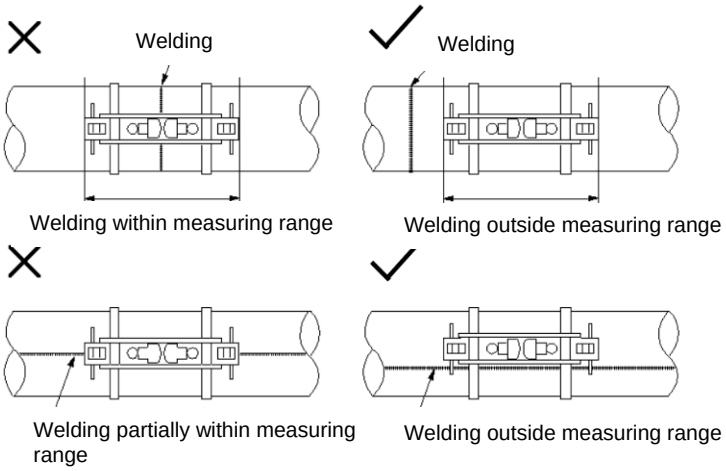


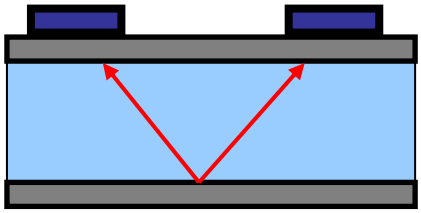
Illustration 3: Installation of the ultrasonic sensors – positioning (1)

5.3 Installation of the ultrasonic sensors

This chapter will inform you on the possible ways to install your ultrasonic sensors. The V mode is the standard way of installation for most applications.

5.3.1 V mode

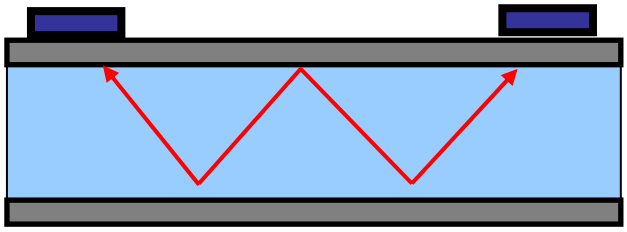
Ultrasonic sensor 1 Ultrasonic sensor 2



Concerning the V mode, both ultrasonic sensors are mounted on the same side of the pipe. In case of small and medium-size pipeline systems, the V mode is the standard way of installation reflecting the ultrasonic signal via the pipe wall.

5.3.2 W mode

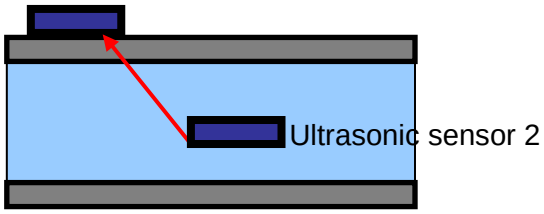
Ultrasonic sensor 1 Ultrasonic sensor 2



The W mode is a special way of mounting your ultrasonic sensors usually applied, if necessary, for small and very small-size pipeline systems.

5.3.3 Z mode

Ultrasonic sensor 1



The Z mode is also a special way to install your ultrasonic sensors. On account of the short signal transmission way, compared to the V and W mode, this installation mode is usually chosen in case of large pipeline systems or when the medium to be measured is highly contaminated or loaded with gas.

6. Metering with the MoniSonic 4900

The flow metering is carried out in 5 steps:

1) Choose the appropriate position to install your ultrasonic sensors
2) Parameterize your MoniSonic 4900
3) Mount the ultrasonic sensors on your pipeline system
4) Adjust the zero point
5) Start the flow measurement

6.1 Parametering

6.1.1 Basic information on the parametering

The chapter „Parametering“ describes how to enter all the data which are required for the flow metering.

1. The „Quick Setup“: By means of the Quick Setup, the MoniSonic 4900 will lead you step by step through all the functions necessary for the parametering. The Quick Setup will be sufficient for most of the existing applications and ensures a fast and efficient parametering within a very short period of time.

2. The „Compl. Setup“: The complete setup allows the selection of all existing functions and even expert setting.

6.2 What has to be parameterized?

1. The outside diameter of the pipe or the pipe circumference

2. The pipe wall thickness; in case of lined pipes, also the lining material and the thickness of the lining.

3. The pipe material

4. The medium to be measured

5. The appropriate ultrasonic sensor

6. The installation mode applied for the ultrasonic sensors

The ultrasonic metering is using the transit time measuring principle. The ultrasonic signals penetrate both the pipeline and the medium. For the calculation of the signal transit-time, the sound speed, the wall thickness and the pipe diameter or circumference are allocated to each medium and to each pipe material or pipe lining, if necessary. The meter has some internally stored tables containing the respective sound speeds of different materials and media. If your material or medium is not listed in these tables, you will have to enter the appropriate sound speed value by hand. At the end of this instruction manual, you will find the corresponding tables with the data on the medium.

6.3 Parametering by means of the Quick-Setup

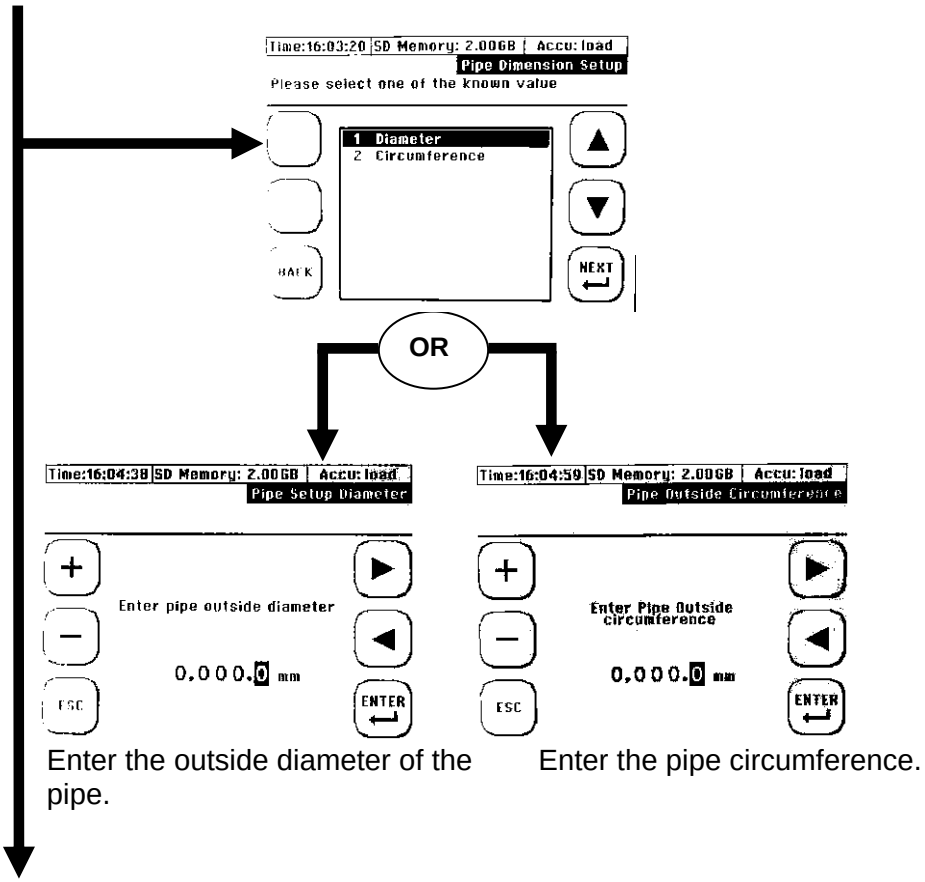
The following steps are necessary to reach the “Parametering” function:

After having switched on your device, select „Setup“ during the start sequence and then „Quicksetup“.

Select „Setup“ and afterwards „Quicksetup“ in the main measurement window „Flow 1“.

Start

1 Select, if you want to enter the pipe circumference or the outside diameter of the pipe:

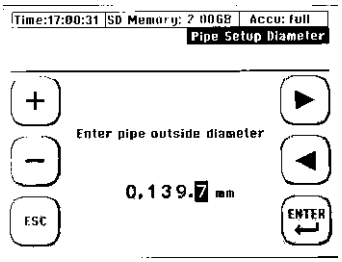


Enter the outside diameter of the pipe.

Enter the pipe circumference.

2

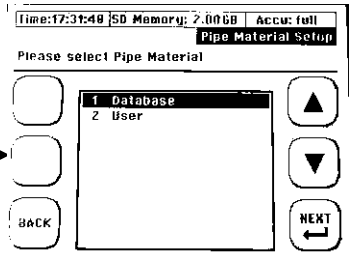
Enter the wall thickness of the pipeline.



If you do not know the wall thickness, we recommend to use a wall thickness measuring device. It is also recommended to use such a device for pipelines with extensive furring.

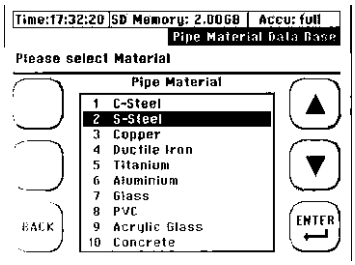
3

Select the pipe material.

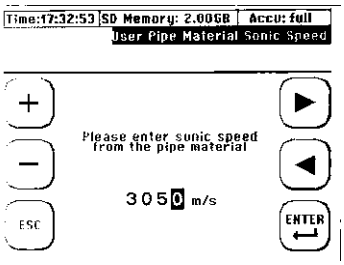


OR

Select the pipe material from the data base.

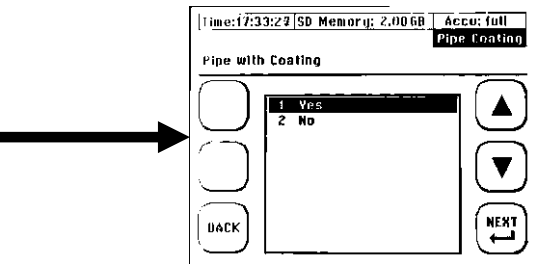


Enter the sound velocity of the pipe material.



4

Does a pipe lining exist? YES/NO



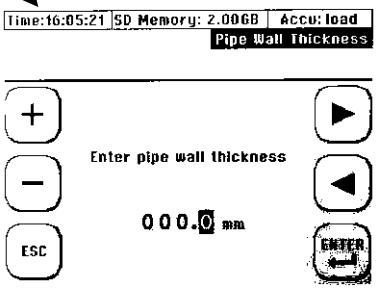
5

NO

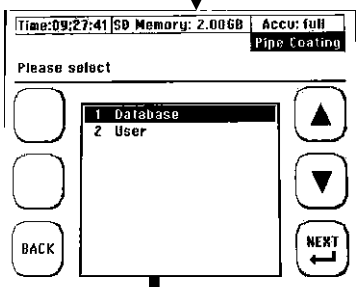
OR

YES

Enter the thickness of the lining.

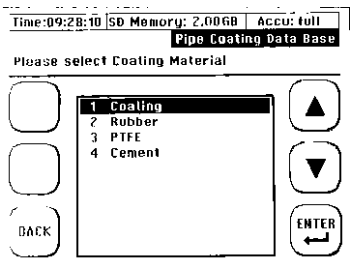


Choose between the database and the user entry for entering materials not listed by the database

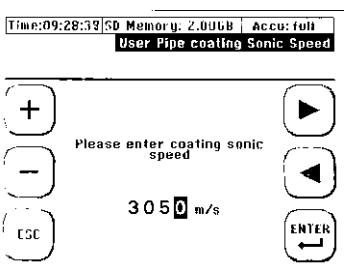


OR

Select the material of the pipe lining from the database.

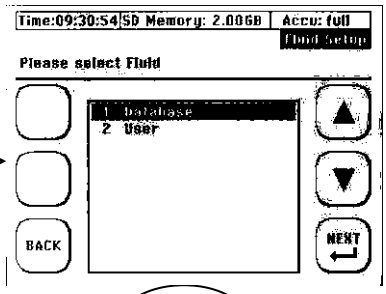


Enter the sound of speed of the pipe lining material

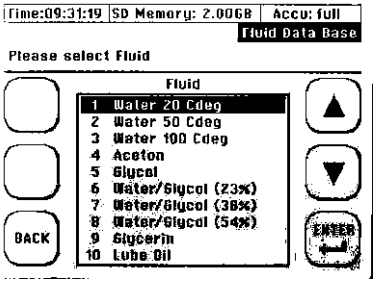


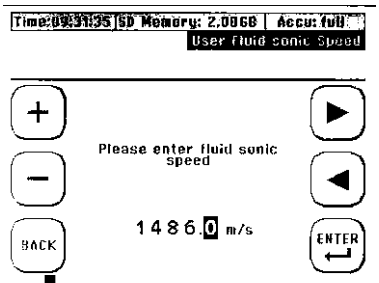
6

Select the medium.

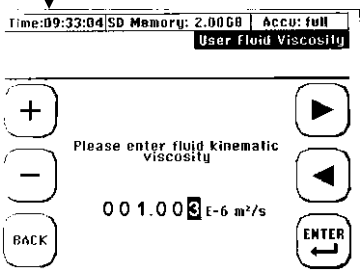


OR

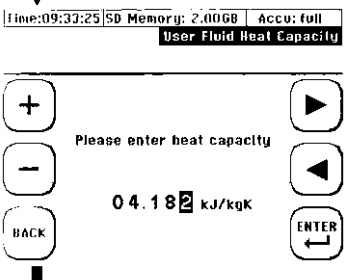




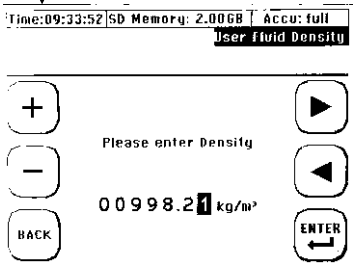
Enter the kinematic viscosity of the medium



Enter the heat capacity of the medium.

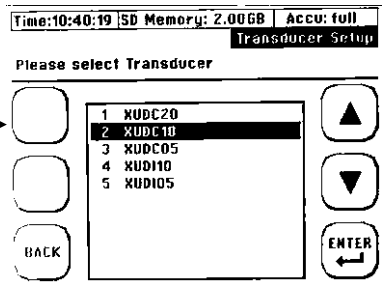


Enter the density of the medium



Select the appropriate ultrasonic sensor.

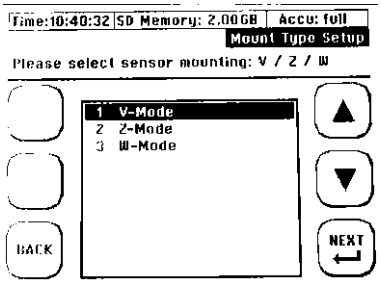
7



See chapter „MoniSonic 4900 and components“ for more information on the appropriate pipe sizes and sensors.

Select the appropriate mode of installation.

8

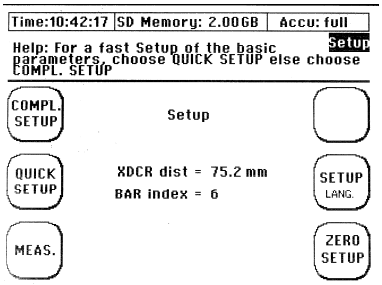


The „V mode“ is the standard mode of installation.
For more information on the installation modes, see the chapter „Preparation of the measurement“.

Output of the distance between the ultrasonic sensors:

9

END



The sensor distance in mm is the distance between the sensor front edges of sensor 1 and sensor 2, regardless of the chosen installation mode.

6.4 Sensor installation/Sensor distance

For all installation modes and ultrasonic sensor types, the distance measurement is effected from the opposite surface of the respective ultrasonic sensor. The required distances will be indicated by the converter after the parametering of the measuring point and will then have to be measured by tape. By using the mounting rail during the V mode, the positioning will be carried out in a simple and comfortable manner via the hole grid of the mounting rail.

6.4.1 Distance for V or W mode

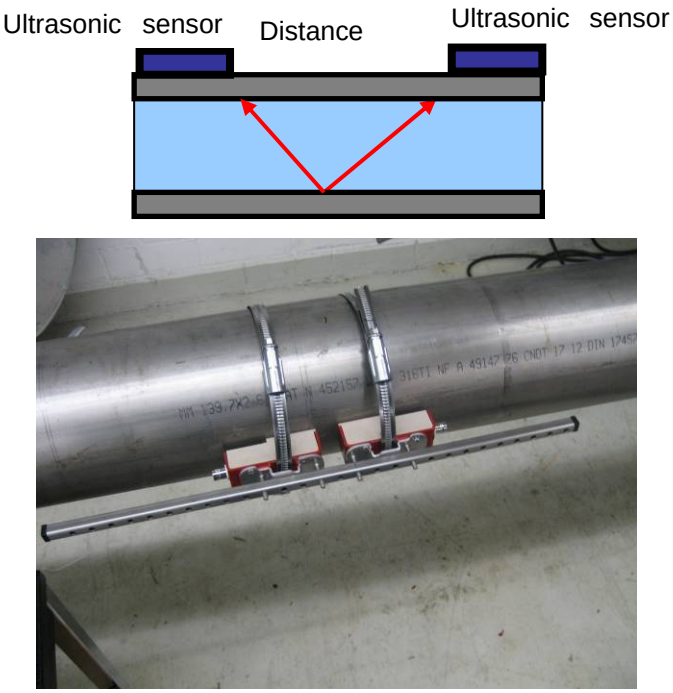
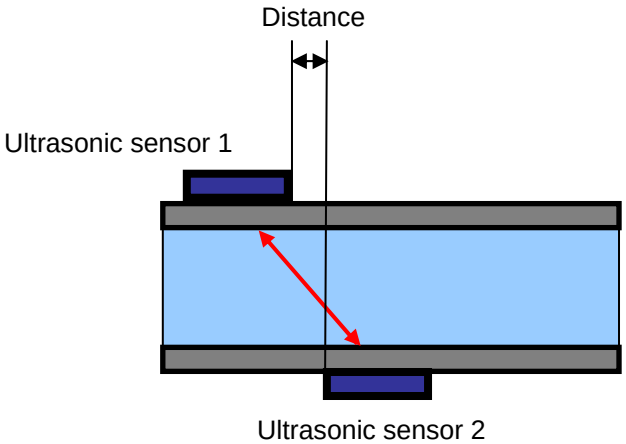


Illustration 4: Example of the V mode with mounting rail

6.4.2 Distance of the ultrasonic sensors – Z mode



6.4.3 Installation of the ultrasonic sensors by means of a mounting rail

After having parametered the measuring point, the converter will indicate the distance in mm and also the hole grid when using the mounting rail (ultrasonic sensor F10, F20). An indicated quantity of 4 holes, for example, will correspond to the number of holes from sensor to sensor:

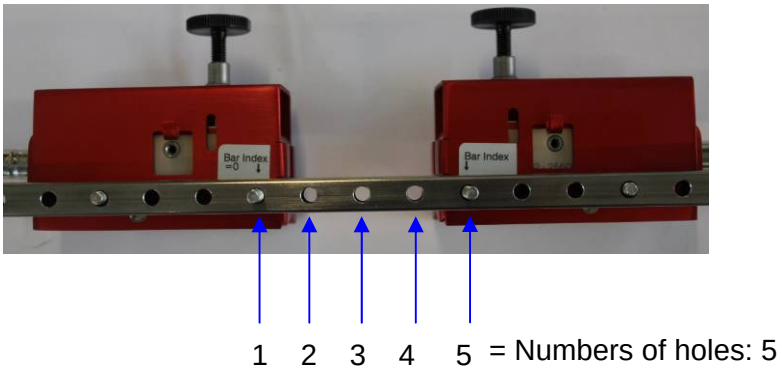


Illustration 5: Positioning of the ultrasonic sensors by means of the mounting rail hole grid

Fix the ultrasonic sensors by means of the enclosed mounting belts made of stainless steel, irrespective of whether you use the mounting rail or not.

Illustration 6: Mounting belt

The mounting belts are dimensioned by the manufacturer for the maximum pipe diameter of the specific ultrasonic sensors ordered by you. In case of small size pipeline systems, it is recommended to shorten the mounting belts before mounting them (approx. 4x the outside diameter).

Illustration 7: Tightener

Pass the tightener through one end of the mounting belt according to illustration 7.

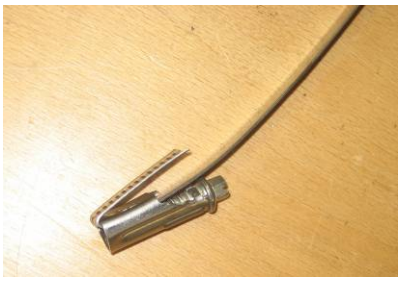


Illustration 8: Fixing the mounting belt

Bend the shorter end of the mounting belt around the tightener to prevent it from slipping off, and follow the illustrations below to mount your ultrasonic sensors. If you choose to use the mounting rail, it will be possible to install both sensors simultaneously to the pipeline. In any case, the sensors must be fixed by means of the mounting belts.

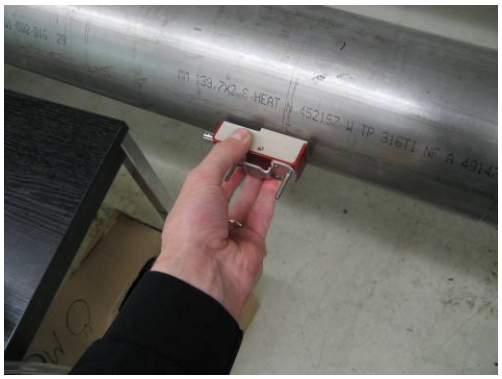


Illustration 9: Initial position

Illustration 10: Threading up the mounting belt

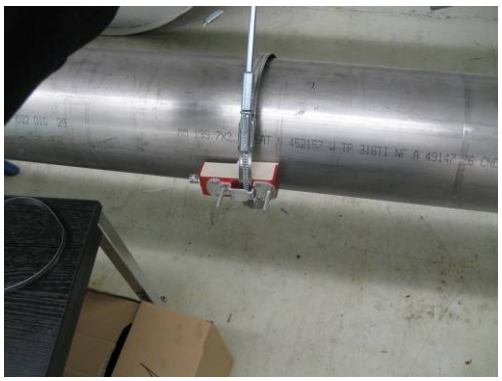


Illustration 11: Tightening of the mounting belt with the tightener

Illustration 12: Final position (without mounting rail)

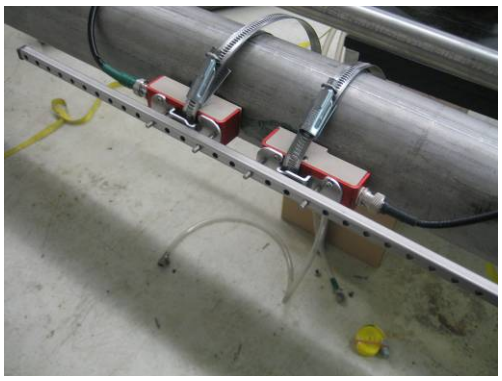


Illustration 13: Final position (with mounting rail)

6.5 Parameter editing via the main menu

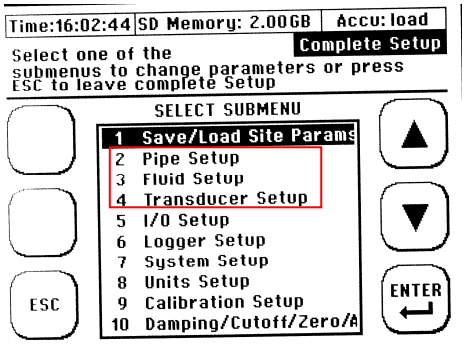
It is also possible to carry out the parametering via the main menu.
Step by step, you will be led through the whole parameterization. The parameter editing via the main menu will be recommended, if you later intend to modify one single parameter.

The parameterization via the main menu, will, however, not be described in detail, since it is practically identical to the complete parametering procedure of the “Quick Setup”.

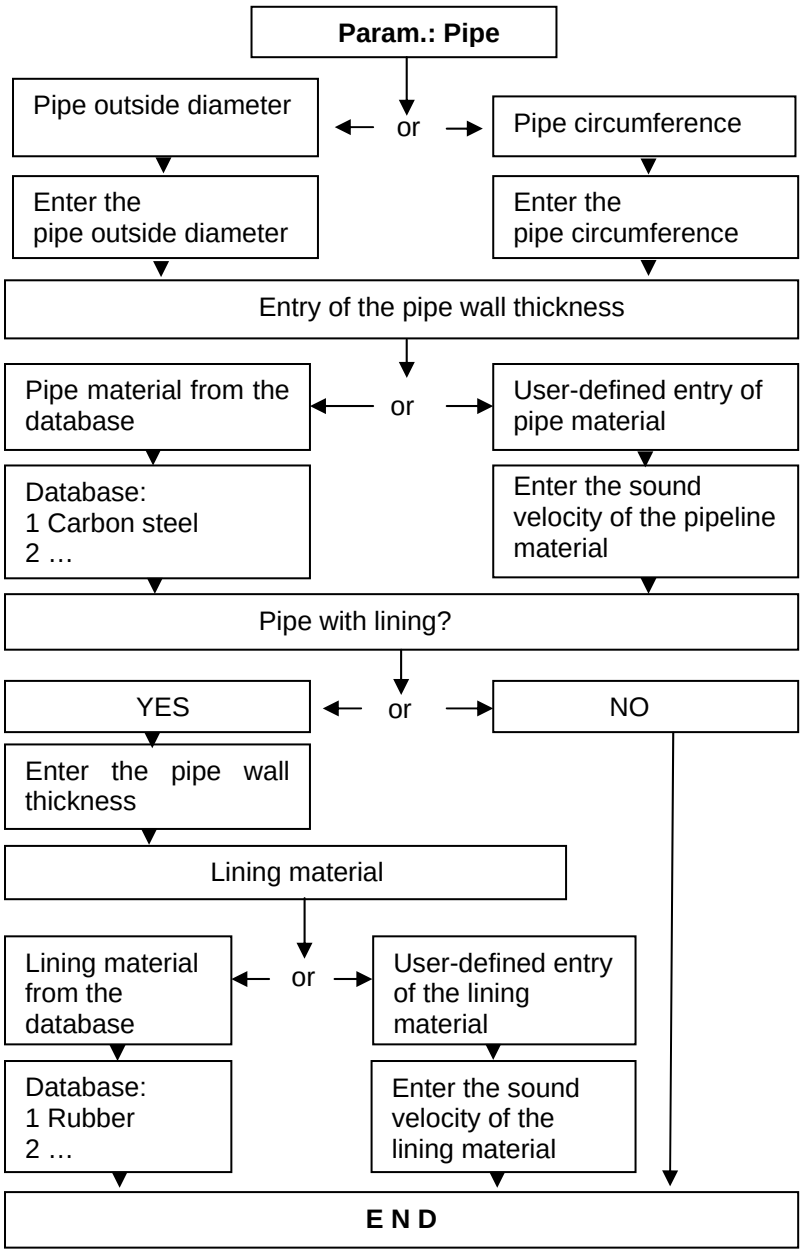
Navigate to the main menu:
Select „Setup“ in the main measuring window „Flow 1“, then select „CMPL. Setup“.

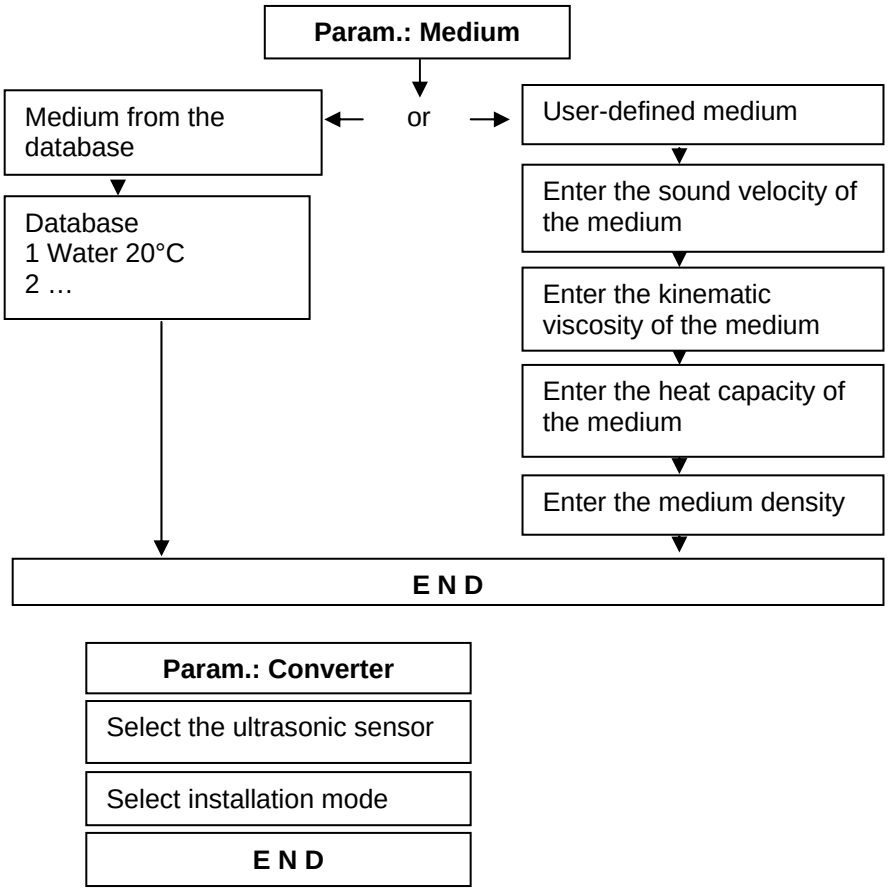
Select the parameter to be modified:

„Pipe“ or „Medium“ or „Converter“:



Now, edit the corresponding functions.


Param.: Pipe
Pipe outside diameter
or
Pipe circumference
Enter the pipe outside diameter
Enter the pipe circumference
Entry of the pipe wall thickness
Pipe material from the database
or
User-defined entry of pipe material
Database: 1 Carbon steel 2 …
Enter the sound velocity of the pipeline material
Pipe with lining?
YES
or
NO
Enter the pipe wall thickness
Lining material
Lining material from the database
or
User-defined entry of the lining material
Database: 1 Rubber 2 …
Enter the sound velocity of the lining material
E N D



6.6 Parameter editing by zero adjustment

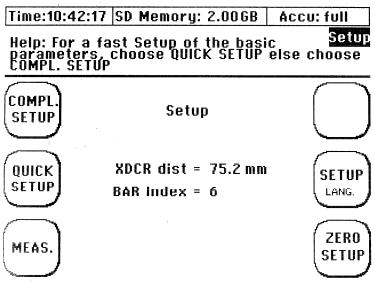
Before starting the measurement procedure, it is recommended to effect the zero adjustment.

⚠ The prerequisites of a correct zero adjustment are a parameterized device with both ultrasonic sensors correctly mounted on the pipeline and connected with the converter.

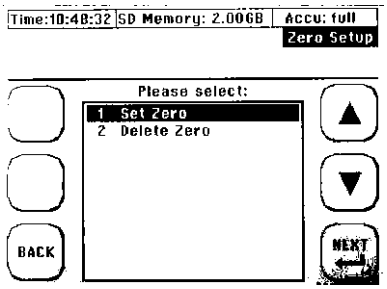
Carry out the following steps:

1. Valve off the pipeline

2. Navigate to the „Setup“ window as follows:
   After having switched on your meter, select „Setup“ during the start sequence or from the main measuring window „Flow 1“.



Now, press „Zero Setup“. You will then see the „Zero adjustment“ window.



4. Select „Zero adjustment“. Acknowledge your entry by pressing the „Enter“ key. The zero point is now set. An already existing zero point will be overwritten. By selecting „Delete zero“, you will delete the last set zero point.

If it is possible to valve off the pipeline, then, after having valved it off, check in the „Flow“ column in one of the three available flow metering windows, if the flow is reduced. Carry out the zero adjustment only when the flow display indicates a steady value after a short period of time. Not any spot of the pipeline is suitable for valving it off. Tolerances due to the assembly work, the ultrasonic sensors and the pipeline specifications will lead to a certain residual deflection of the meter. In case of a precise installation, this residual deflection or zero offset will be in a flow rate range of 0.00-0.03m/s. The larger the pipeline, the smaller the residual deflection usually is. If a zero adjustment is not possible, you will have to consider the additional measuring uncertainty. The set zero point will remain in your device as long as this value is overwritten by a new zero point.

6.7 Heat quantity measurement

The integrated function for the heat quantity measurement will determine the heat or refrigerating quantity of your application by means of the optionally available PT100.

6.7.1 Introduction

The PT100 n° 1 will be mounted to the hot side of the cycle; the PT100 n° 2 will be installed on the cold side. The ultrasonic sensors can either be mounted on the hot side or on the cold side. It is, however, recommended to install them on the cold side, since the sensors will surely not be operated above the permissible maximum temperature.

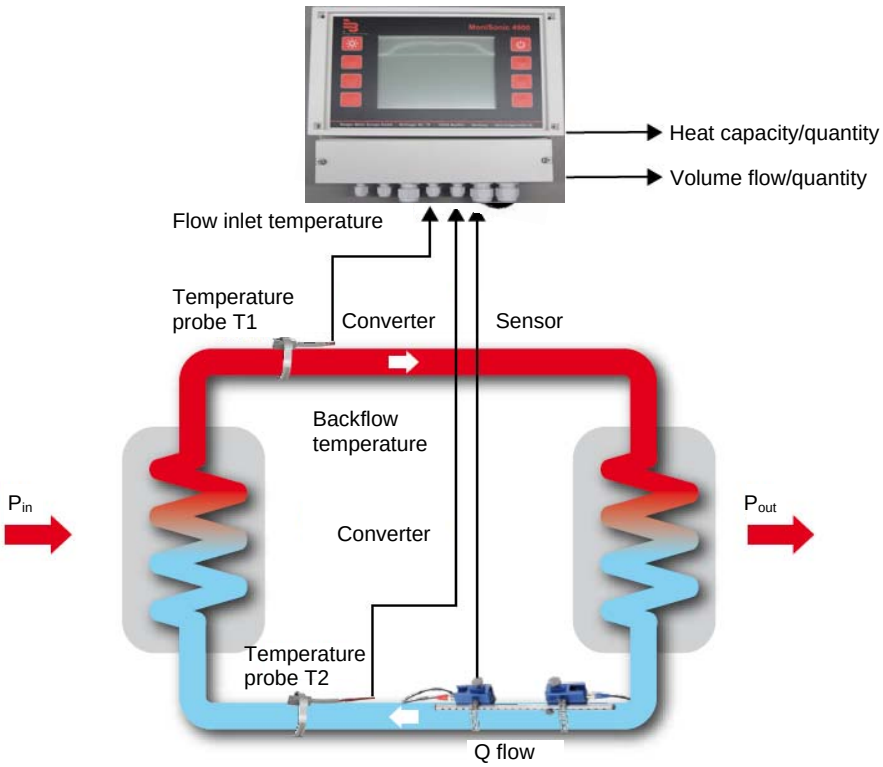


Illustration 14: Shematic view of the heat quantity measurement

The meter indicates the heat capacity and the accumulated heat quantity.

Determination of the heat capacity:

The cross-sectional area of the inner pipe diameter [A] is multiplied by the velocity of flow [v], by the specific heat capacity of the medium [cw] as well as by the temperature difference of both PT100, [Thot – Tcold]. The result is the heat capacity [Q] indicated in watt.

$$Q = A \cdot v \cdot c_w \cdot (T_{hot} - T_{cold}) \qquad Q = [W, kW]$$

Determination of the heat quantity:

The heat quantity results from the heat capacity per time.

$$Q = \int \dot{Q} dt \qquad Q = [J, kW/h]$$

6.7.2 Installation of the PT100

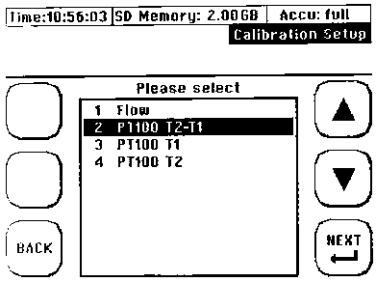
Depending on the existing temperatures, the PT100 can either be fixed to your pipeline by means of a metal tightening strap (see photo) or by a textile tightening strap. Mount the PT100 on your pipe as follows:

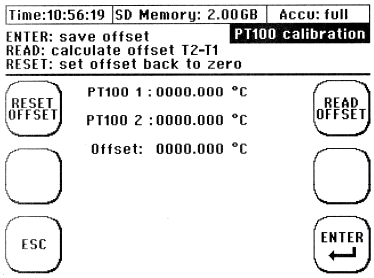
6.7.3 Zero adjustment of the PT100

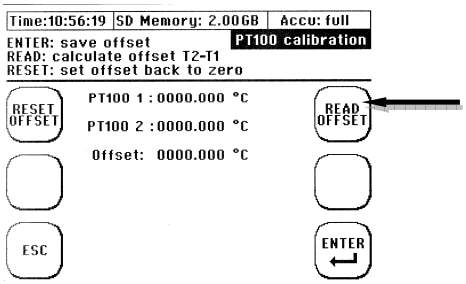
Select „SETUP“ and afterwards „COMPL SETUP“ in the main measuring window „Flow 1“. Navigate to „Calibration“ in the main menu and select „Calibration PT100“.

Before mounting the sensors on the pipe, adjust the sensors in such a way that the temperature difference between both PT100 is nearly zero degrees. Avoid touching the sensors before effecting the zero adjustment. To check the temperatures of both sensors, use the display in the measuring window „Heat capacity“ of the next chapter.

Preset the value for the first PT100:







7. Measuring windows of the MoniSonic 4900

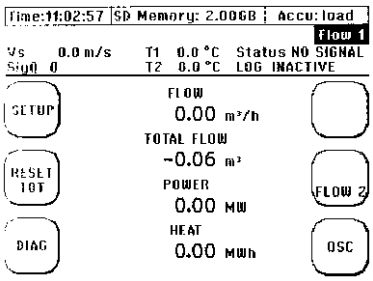
7.1 Main measuring window: „Flow 1“

Navigate to the main measuring window: „Flow 1“ as follows:

Wait approximately 5 seconds after having activated your device. While the start screen is displayed, the MoniSonic 4900 will automatically switch to the main measuring window: „Flow 1“.

Select „ESC“ → and then „MEAS“ in the main menu.

The flow measuring window 1 will indicate in a compact way all required information concerning your flow, heat capacity and heat quantity measurements.



Function:	Explanation:
Flow 0,000 l/min	Indicates the current flow
Totalizator 0,000 m³	Totalizator = Flow meter
Capacity 0,00 MW	Indicates the current rate of flow. Indicates the current heat capacity.
Heat capacity 0,00 MWh	Indicates the current heat quantity.
Vs 0,0	Indicates the sound velocity of the medium.
SigQ 0	Indicates the signal quality in % .
T1 0,0 °C T2 0,0 °C	Output of the PT100 temperature when PT100 is connected.
Status 0	Displays the status of the measurement procedure.

RESET TOT Resets the totalizator to zero.

DIAG Changes to the diagnosis windows. This will only be necessary, if no measuring results are indicated.

FLOW 2 Changes to the measuring window: „Flow 2“.

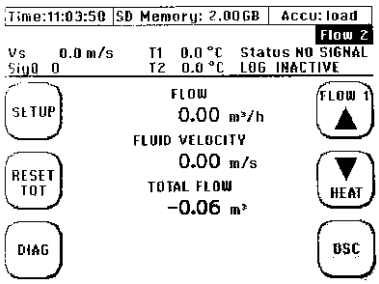
LOG Changes to the „Data logger“ window.

7.2 „Flow 2“ measuring window

Navigate to the main measuring window: „Flow 2“ as follows.

Select „Flow 2“ in the main measuring window: „Flow 1“.

The flow measuring window 2 will indicate in a compact way all required information on the flow metering (without the heat quantity measurement). In addition, you will be informed on the velocity of flow as well.



Function:	Explanation:
Flow velocity 0,00 m/s	Indicates the current velocity of flow.

Changes to the main measuring window „Flow 1“.

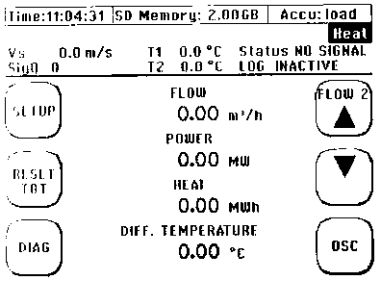
Changes to the „Heat capacity“ measuring window.

7.3 „Heat quantity“ measuring window

Navigate to the main measuring window: „Heat quantity“ as follows:

Select „Flow 2“ and subsequently „Heat“ in the main measuring window: „Flow 1“.

The „Heat quantity“ measuring window indicates in a compact way all required information on your heat quantity measuring.



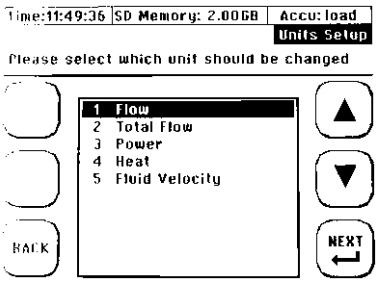
Function:	Explanation:
Capacity 0,00 MW	Indicates the current heat capacity.
Heat quantity 0,00 MWh	Indicates the current heat quantity.
Temperature difference 0,00 °C	Indicates the temperature difference of the connected PT100 between PT100 n° 1 and PT100 n° 2.
FLOW 2 ▲	Changes to the measuring window: „Flow 2“.

7.4 Unit selection

Navigate to the „Units“ menu as follows:

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „Units“.

Select the function for which you intend to modify the unit:

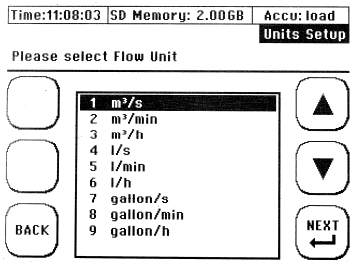


7.4.1 Selection of the flow unit

Navigate to the “Units”submenu: „Flow“ as follows:

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „Units“ and select „Flow“.

Select the required unit:



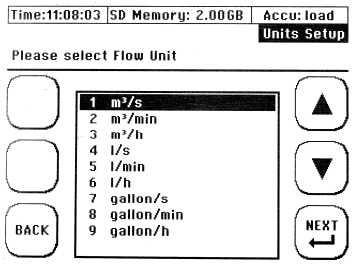
The unit „gallon“ means metric gallon.

7.5 Selection of the flow meter unit

Navigate to the “Units” submenu: „Flow meter“ as follows:

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „Units“ and select „Flow meter“.

Select the required unit:



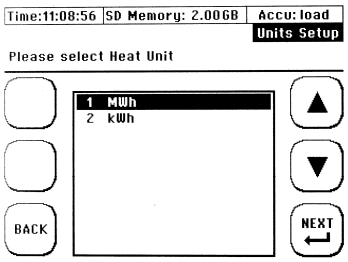
The unit „gallon“ means metric gallon.

7.5.1 Selection of the heat energy unit

Navigate to the “Units” submenu: „Heat energy“ as follows:

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „Units“ and select „Heat energy“.

Select the required unit:

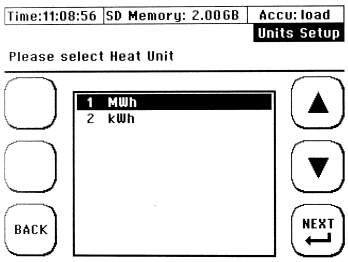


7.5.2 Selection of the heat capacity unit

Navigate to the „Units“ submenu: „Energy“ as follows:

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „Units“ and select „Heat quantity”.

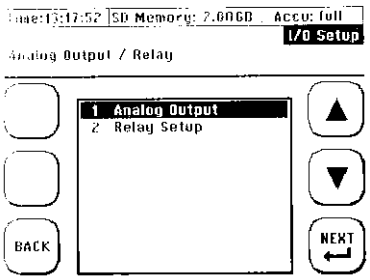
Select the required unit:



8. Parametering of the inputs and outputs

Navigate to the „Input/output setting“ menu as follows:

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „I/O setting“.



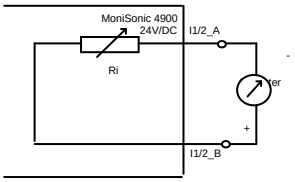
8.1 Parametering of the 4-20mA outputs

The MoniSonic 4900 has two 4-20mA outputs. You may allocate different measured values to these outputs. The outputs are active ex works, i.e. they are voltage fed by the MoniSonic 4900. It is, however, also possible to feed them by an external (passive) supply point. In case of an external supply, the voltage range must be within 10 to 30 V.

⚠ If the 4-20mA outputs of the meter are active and if you connect the analogue outputs of the MoniSonic with an external device which also has active inputs, severe damages will occur to the MoniSonic and to the external device.
Therefore, before connecting the two devices, make sure that only one device is active!

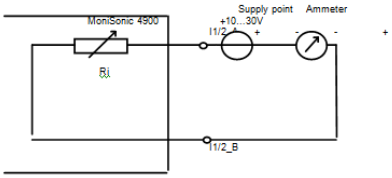
The inputs of the MoniSonic 4900 are active (preset).
The inputs of the external device are directly connected with the MoniSonic 4900.

Active 1:



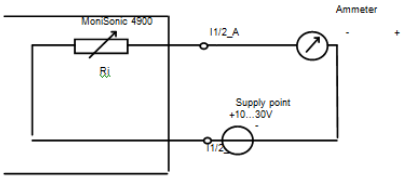
The output is active (factory-set)

Passive 1:



The output is passive.

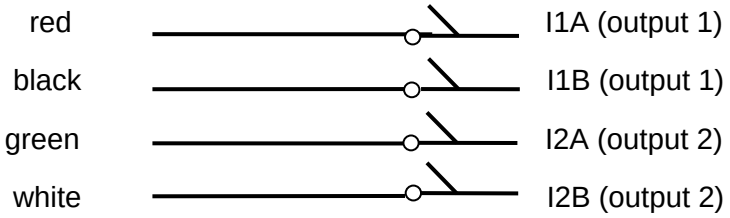
Passive 2:



The output is passive (to be adjusted in the device).

The supply point is connected in series to the MoniSonic 4900 which is externally fed. At the inputs, the MoniSonic 4900 has a semiconductor circuit dynamically regulating the resistance.

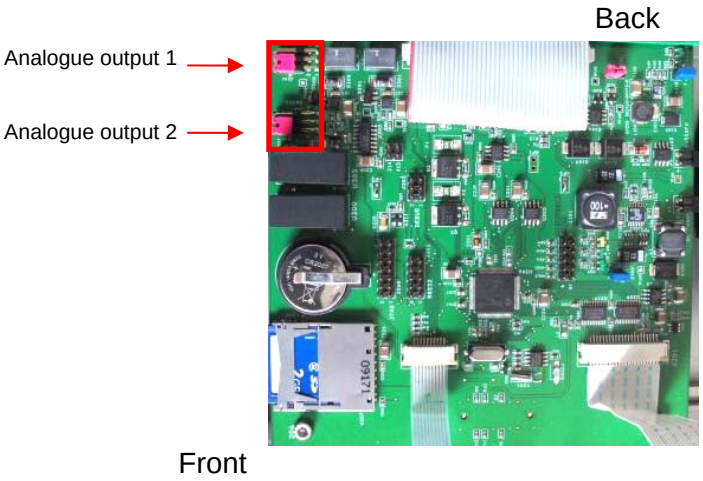
8.2 Colour coding of the 4-20mA output cable



Output 1 (I1A/B): The direction of the current is from I1B to I1A.
Output 2 (I2A/B): The direction of the current is from I2B to I2A.

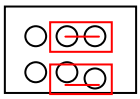
Deactivation of the outputs (passive):
See chapter „Maintenance“ for instructions how to open your MoniSonic 4900.

The illustration shows active jumpers (preset).

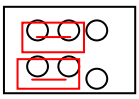


Use small pliers or tweezers to remove the jumpers.

Active voltage



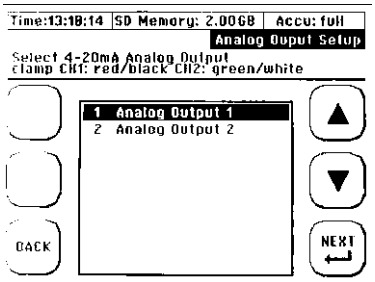
Passive voltage



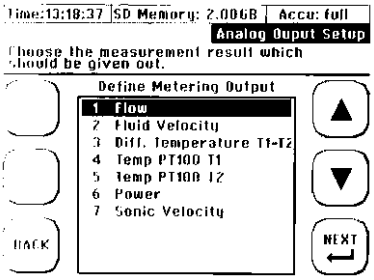
Navigate to the „Analogue output“ menu as follows:

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „I/O setting“ and select „Analogue outputs“.

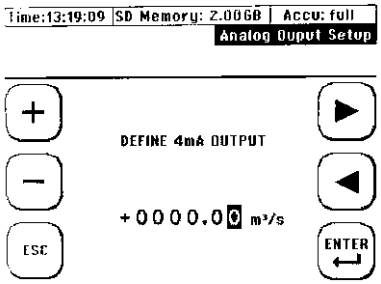
Select which analogue output you intend to use.



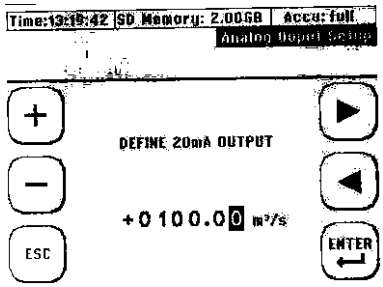
Select the function to be supplied by the analogue output.



Select the value to be allocated to the 4mA output.

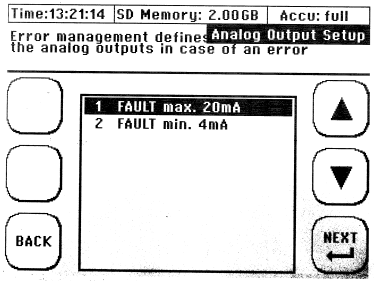


Select the value to be allocated to the 20mA output.

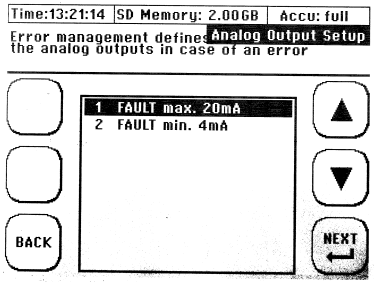


What, if a value falls below or exceeds the parameterized value?
Example: You expect a flow rate of 100m³ and you have allocated this value to the 20mA output. Temporarily, there is, however, a flow rate of 130m³. In this case, there is always a 20mA output, even for the flow >100m³ .

Select after which period of time an error output should be effected (burnout).



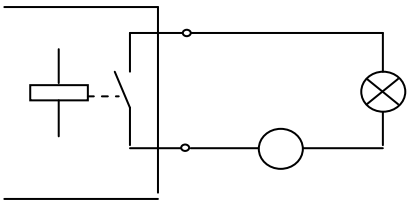
Select the output flow rate supplied in case of an error.



8.3 Parametering of the relay

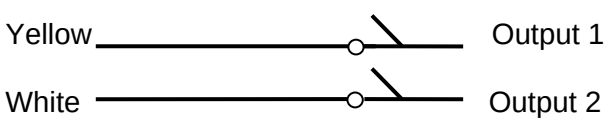
The MoniSonic 4900 has a relay output. It is possible to allocate both a function and a range to the output.

Example of an external circuit:



It is, for instance, possible to couple a warning light to the output to indicate that the flow rate has fallen below a certain minimum flow rate.

8.4 Colour coding of the relay output cable

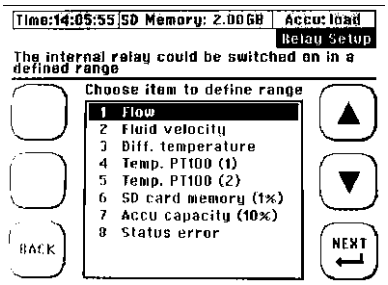


⚠ The relay is NO (normally open); i.e. the switching contact of the relay is open. It will be closed only, if it is triggered by a parameterized function. The switching contact remains also open in case of a voltage loss/empty battery.
The polarity of the connecting points does not need to be taken into account.

Navigate to the „Analogue output“ menu as follows:

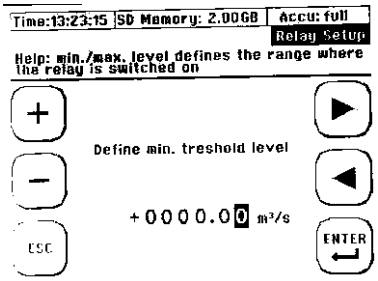
Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „I/O setting“ and select „Relay“.

Select the function.

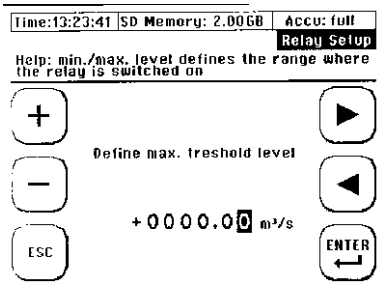


Select the minimum value at which the relay will be activated/switched on.

ℹ While parametering functions like for example the flow rate, the MoniSonic 4900 will also set the corresponding unit which has been selected before in the „Unit setting“ and displayed in one of the measuring windows behind the respective function. Example: If you select “cubic metre” as the unit for the flow rate, the values of the switching points will also be indicated in cubic metres.


Time:13:23:15 SD Memory: 2.00GB Accu: full
Relay Setup
Help: min./max. level defines the range where the relay is switched on
Define min. treshold level
+0000.00 m³/s
ESC
ENTER

Select the maximum value at which the relay will be deactivated/switched off.


Time:13:23:41 SD Memory: 2.00GB Accu: full
Relay Setup
Help: min./max. level defines the range where the relay is switched on
Define max. treshold level
+0000.00 m³/s
ESC
ENTER

Example:
A pump is operated in an application and the pump capacity is measured. The maximum pump capacity is 6,000m³. Below a capacity of 150m³ the pump might be damaged. Therefore, the MoniSonic 4900 is to ensure that the pump will stop when the respective limiting value for causing damages is reached.

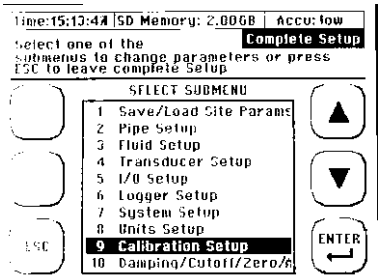
The prerequisite, however, is that “cubic metre” has been selected as the flow rate unit. Thus, the minimum switching point will be parameterized.

9. Calibration

It is possible to calibrate your MoniSonic 4900. You can calibrate the flow as well as the analogue outputs and the PT100.

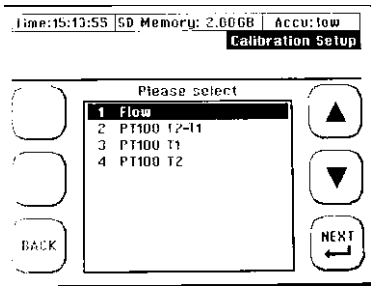
Navigate to the calibration menu as follows:

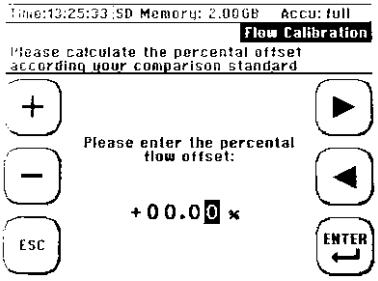
Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „Calibration“.



9.1 Flow calibration

Select „Flow“ in the calibration menu.





Then, enter the deviation in percent according to your calibration standard.

When calibrating your MoniSonic 4900, we recommend to carry out measurements at different rates of flow and to determine the average value of the measuring results afterwards.
During a factory calibration, we determine the average value by means of five different flow rates.
The entered flow offset will be stored within the meter until it is overwritten by a new value.

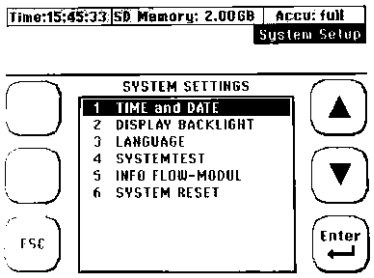
9.2 Calibration of the PT100

For more detailed information on the calibration of the PT100, see the chapter “Heat quantity measuring“,“Zero adjustment of the PT100“.

10. System setup

Navigate to the system setup menu as follows:

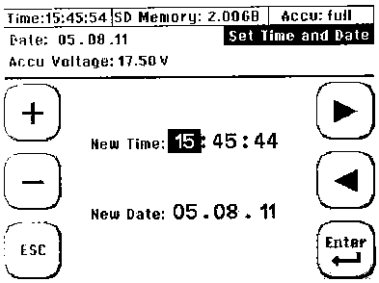
Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „System setup“.



10.1 Change of time and date

Navigate to the „Time and date“ window as follows:

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „System setup“ and select „Time and date“.

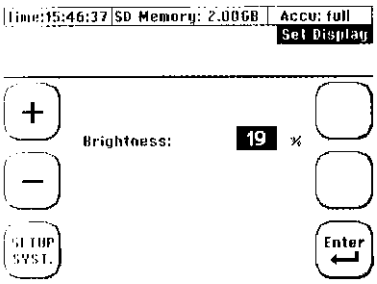


Enter the time by using the format hh (hour): mm (minutes) : ss (seconds).

10.2 Change of “Background lighting“

Navigate to the „Background lighting“ window as follows:

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „System setup“ and select „Background lighting“.



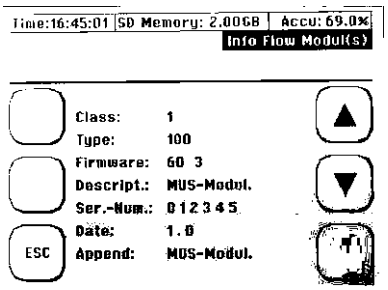
Now adjust the light intensity of the display.

10.3 Change of the menu language

The following two ways are possible to navigate to the „Language“ window:

Directly after having switched on your device, press the multi-functional key during the start sequence. The multifunctional key is situated beside the „SETUP LANG.“ field.

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „System setup“ and select „Language“.



⚠ Note: By changing the language, you also change the language of the menus. The language in the fields beside the multifunctional key will remain, however, unchanged.

10.3.1 System setup of „Other“

Navigate to the „Other“ window as follows:

Select „SETUP“ and afterwards „COMPL SETUP“ in the „Flow 1“ main measuring window. In the main menu, navigate to „System setup“ and select „Other“.

11. Troubleshooting

Use the checklist indicated below to trace errors and work it through point by point. If no or only a faulty measurement is possible even after having completely worked through the list, then please contact us.

Please, keep the following information ready when contacting us:

- Pipe material
- Pipe outside diameter
- Wall thickness
- Medium, medium temperature
- Type/length of the inflow and outflow ways
- Sensor type to be used

Print out the Troubleshooting Guide „Failure correction“ and work it through with care point by point. Possibly, this may help you to keep cool in case of a difficult application and to effect a systematic error diagnosis.

Trouble shooting

A. Flow metering is not possible:

1A.	Is the pipeline completely filled up?	☐
2A.	Is the medium loaded with gas? Is there a pump nearby? (A maximum gas load of 12% Vol is allowed). If your medium is loaded with gas: • Have you mounted the sensors at the 10 o'clock or 14 o'clock position in case of a horizontal pipeline? • If your medium is loaded with gas, is it possible to mount the sensors on a vertical pipeline? If so, then mount the sensors on a vertical pipeline.	☐
3A.	Does the medium contain solid matter? Which amount of solid matter does the medium contain? (a maximum share of 10g/l is allowed)	☐
4A.	Do you exactly know the wall thickness? Take a close look at the pipeline, if there are any engravings. In case of hot water pipelines, furring may have formed that will deposit, if the medium contains a high amount of solid matter. Use a wall thickness meter. You may lease or buy such a wall thickness meter from us. Check the wall thickness value entered in your device.	☐
5A.	Did you enter the outside diameter or the circumference of the pipe? Verify the corresponding values once again.	☐
6A.	Did you select the correct pipeline material? Is it for sure that the pipeline system **does not have any lining?** Effect some measurement at a concrete pipeline, because this type of pipe has no sound transmitting characteristics. Check the parameterized values.	☐

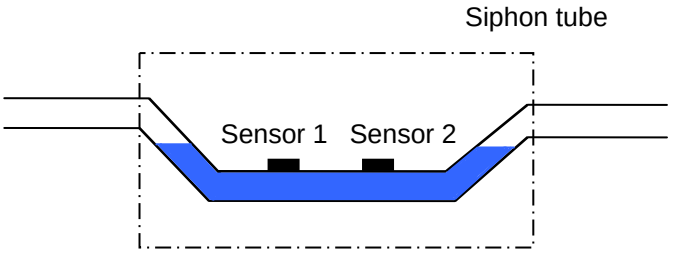
7A.	Is the ultrasonic sensor appropriate for the intended application or the pipe size and the temperature of the medium? Is the temperature of the medium within the permissible temperature range? Did you select the correct ultrasonic sensor for	☐

	your application or for the corresponding pipe size? Check again, if the correct sensor was selected and parameterized.	
8A.	Which installation mode did you select for the sensors? The standard installation mode is the V mode. If you have chosen the W mode, then try first of all the V mode.	☐
9A.	Is the distance between the sensors correct? You should measure from the sensor front. When using the mounting rail, count the number of holes between the installation points of the sensors. Do not include the knurled screws of the sensors!	☐
10A.	Does the pipeline have a thick coat of paint? If so, then try to remove the paint (by sanding, for example) at the position where you intend to mount the ultrasonic sensors. It is absolutely not possible to effect any measurements on a pipeline insulation, regardless of the insulation type!	☐
11A.	Did you apply a sufficient amount of acoustic coupling gel (Magnalube) on the sensor surfaces? Small sensors (XUDC10 and 20) require approx. 3cm of coupling gel, the large sensor (XUDC05) will need approx. 6cm of coupling gel.	☐
12A.	Is there sufficient contact pressure between the sensors and the pipeline?	☐
13A.	If you have mounted the sensors without using the mounting rail: Have the sensors been installed in a straight line and in a centred way (!) on the pipeline? Are they exactly aligned?	☐
14A.	Do intense sources of interference exist in the immediate proximity, like transformers, electric motors, or vibrating devices?	☐
15A.	If all efforts do not show any results, then use the Z mode. Parameterize your meter in the corresponding way. Do also carry out a test measurement at another near pipeline to find out if measuring is possible at all. Check, if the instrument leads are damaged.	☐

B. Inexact measuring results		
1B.	Did you keep the respective inlet and outlet distances? The shorter the inlet and outlet distance, the more inexact the measuring results will be.	☐
2B.	Did you effect a zero adjustment after having valved off the pipeline?	☐
3B.	Verify once again the parameterized values of: • The pipe outside diameter • The wall thickness • The pipe material • The sensor distance	☐

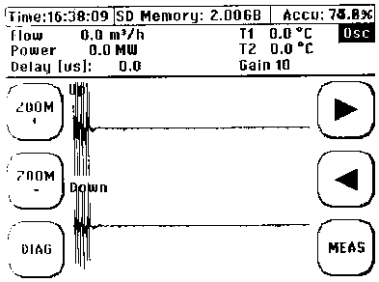
11.1 What to do if the pipeline is not completely filled up?

If a simple separation of the pipelines is possible, in case of plastic pipes, for example, or if the application is still planned or under construction, we recommend to use a siphon tube. The gradient of the siphon tube has to be dimensioned according to the expected flow (flow rate) and the dirt load. If it is necessary to use a siphon tube for your application, then do not hesitate to ask us.



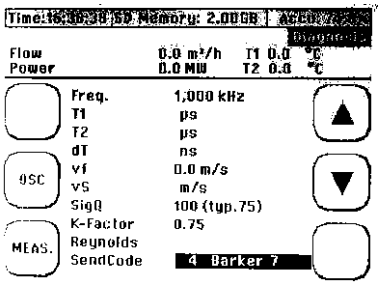
11.2 The diagnostic windows of the MoniSonic 4900

Signal window



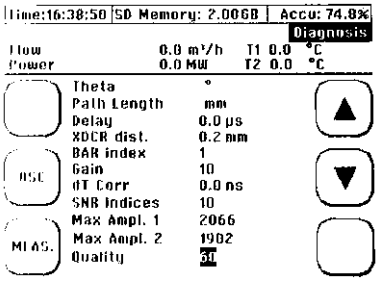
In the signal window you can see the signal packages of both sensors. The first signal package (UP) indicates the ultrasonic signals in the flow direction; the second signal package (DOWN) indicates the ultrasonic signals against the flow direction.

Diagnostic window 1 of 2:



Frequency:
These are the transmitting frequencies of 500kHz (XUDC05), 1000kHz (XUDC10) and 2000kHz (XUDC20).
Signal:
Indicates the signal form, the standard is 233, i.e. 2 pulses, then phase commutating, subsequently 3 pulses, then phase commutating, then 3 pulses. By commutating the phases, the signal will receive a special form (coding) and can, therefore, also be found during interferences.
T1:
Is the signal transit time of one direction (either in or against the flow direction), depending on the connection mode of the signal cables with the meter.
T2:
Is the signal transit-time of the other direction (either in or against the flow direction, depending on the connection mode of the signal cables with the meter).
dT:
Is the transit-time difference of the signals.
vF:
Indicates the flow velocity of the medium.
Vs:
Indicates the sound velocity of the medium.
Reynolds:
The Reynold's number will indicate if the cross section of the flow is laminar (<1400) or turbulent (>8000).
Transmission coding:
Coding of the ultrasonic signals (see above „Signal").

Diagnostic window 2 of 2



Theta:
Indicates the path angle within the medium
Path length:
This is the length of the acoustic path within the medium
Delay:
This is the calculated delay until the signals will be displayed in a centred way in the signal window.
Sensor distance:
This is the distance in mm between the sensor fronts
Hole grid:
This is the number of holes between the mounting positions of the ultrasonic sensors.
Amplification:
This is the internal pre-amplifier to amplify the ultrasonic signals with automatic control within a range of 0-255 (AGC) with 0 as the lowest value and 255 as the highest value.
Time correction:
This is the time recorded during a zero adjustment.

12. Maintenance

None of the components of the MoniSonic 4900 requires any maintenance. However, it might be possible that you have to open the device to switch the analogue outputs (active/passive).

12.1 Opening the device

Remove the plastic covers first. Loose the screws by means of a crosstip screwdriver. Pull off the front cover carefully.

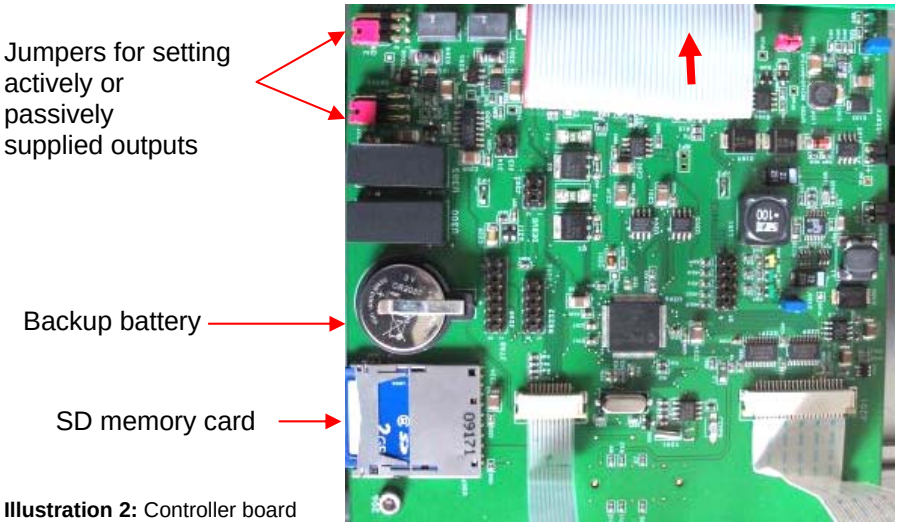
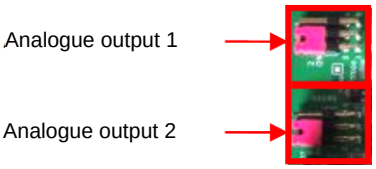


Illustration 2: Controller board

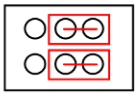
12.2 Connecting the analogue outputs with externally fed supply points

The illustration shows actively jumpered analogue outputs.

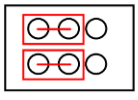


For a passive operation, set the jumpers as shown below.
Use small pliers or tweezers to move the jumpers.

Active voltage



Passive voltage



13. Medium data

Sound velocity and density of various liquids:

Liquid	T°C	pg/cm³	Vm/s
Acetone	20	0.7905	1190
Aniline	20	1.0216	1659
Alcohol	20	0.7893	1168
Ether	20	0.7135	1006
Ethylene glycol	20	1.1131	1666
N-octane	20	0.7021	1192
O-xylene	20	0.871	1360
Chloroform	20	1.4870	1001
Chlorbenzene	20	1.1042	1289
Glycerine	20	1.2613	1923
Ethanoic acid	20	1.0495	1159
Methyl acetate	20	0.928	1181
Ethyl acetate	20	0.900	1164
Cyclohexane	20	0.779	1284
Dithionic acid	20	1.033	1389
Deuterium oxide	20	1.1053	1388
Carbon tetrachloride	20	1.5942	938
Mercury	20	13.5955	1451
Nitrobenzene	20	1.207	1473
Carbon bisulphide	20	1.2634	1158
Chloroform	20	2.8904	931
n-propyl alcohol	20	0.8045	1255
n-pentane	20	0.6260	1032
n-hexane	20	0.654	1083
Easily liquefiable oil	25	0.81	1324
Transformer oil	32.5	0.859	1425
Spindle oil	32	0.905	1342
Petrolatum	34	0.825	1295
Gasoline	34	0.803	1250
Water	13.5	1.000	1460
Sea water (Salt content: 3.5%)	16	1.000	1510

T: Temperature, p: Density, V: Sound velocity

Sound velocities of water depending on the medium temperature (0 up to 100°C):

T°C	Vm/s	T°C	Vm/s	T°C	Vm/s	T°C	Vm/s
0	1402.74						
1	1407.71	26	1499.64	51	1543.93	76	1555.40
2	1412.57	27	1502.20	52	1544.95	77	1555.31
3	1417.32	28	1504.68	53	1545.92	78	1555.18
4	1421.98	29	1507.10	54	1546.83	79	1555.02
5	1426.50	30	1509.44	55	1547.70	80	1554.81
6	1430.92	31	1511.71	56	1548.51	81	1554.57
7	1435.24	32	1513.91	57	1549.28	82	1554.30

8	1439.46	33	1516.05	58	1550.00	83	1553.98
9	1443.58	34	1518.12	59	1550.68	84	1553.63
10	1447.59	35	1520.12	60	1551.30	85	1553.25
11	1451.51	36	1522.06	61	1551.88	86	1552.82
12	1455.34	37	1523.93	62	1552.42	87	1552.37
13	1459.07	38	1525.74	63	1552.91	88	1551.88
14	1462.70	39	1527.49	64	1553.35	89	1551.35
15	1466.25	40	1529.18	65	1553.76	90	1550.79
16	1469.70	41	1530.80	66	1554.11	91	1550.20
17	1473.07	42	1532.37	67	1554.43	92	1549.58
18	1476.35	43	1533.88	68	1554.70	93	1548.92
19	1479.55	44	1535.33	69	1554.93	94	1548.23
20	1482.66	45	1536.72	70	1555.12	95	1547.50
21	1485.69	46	1538.06	71	1555.27	96	1546.75
22	1488.63	47	1539.34	72	1555.37	97	1545.96
23	1491.50	48	1540.57	73	1555.44	98	1545.14
24	1494.29	49	1541.74	74	1555.47	99	1544.29
25	1497.00	50	1542.87	75	1555.45	100	1543.41

T: Temperature, V: Sound velocity

Kinematic viscosity coefficient of various liquids:

Liquid	T°C	pg/cm³	Vm/s	v (x10-6m²/s)
Acetone	20	0.7905	1190	0.407
Aniline	20	1.0216	1659	1.762
Ether	20	0.7135	1006	0.336
Ethylene glycol	20	1.1131	1666	21.112
Chloroform	20	1.4870	1001	0.383
Glycerine	20	1.2613	1923	1188.5
Ethanoic acid	20	1.0495	1159	1.162
Methyl acetate	20	0.928	1181	0.411
Ethyl acetate	20	0.900	1164	0.499
Deuterium oxide	20	1.1053	1388	1.129
Carbon tetrachloride	20	1.5942	938	0.608
Mercury	20	13.5955	1451	0.114
Nitrobenzene	20	1.207	1473	1.665
Carbon bisulphide	20	1.2634	1158	0.290
n-pentane	20	0.6260	1032	0.366
n-hexane	20	0.654	1083	0.489
Spindle oil	32	0.905	1324	15.7
Gasoline	34	0.803	1250	0.4 to 0.5
Water	13.5	1.	1460	1.004 (20°C)

T: Temperature, p: Density, V: Sound velocity, v: Kinematic viscosity

Sound velocity of various pipe materials:

Material	Vm/s
Iron	3230
Steel	3206
Ductile cast iron	3000
Cast iron	2460
Stainless steel	3206
Copper	2260
Lead	2170
Aluminium	3080
Brass	2050
Vinyl chloride	2640
Acrylic	2644
FRP	2505
Mortar	2500
Tar Epoxy	2505
Polyethylene	1900
Teflon	1240

V: Sound velocity

14. Technical data

Operating voltage		100-240 V/AC or 18-36VDC
Operating temperature		-20°C up to +60°C
System of protection (converter)		IP54
Weight (converter)		1.3kg
Display		LCD 320x240 Dimmable background lighting
Measuring range		-30 up to +30 m/s
Signal damping		0 up to 100 sec. (adjustable)
Inputs/Outputs		
Analogue outputs		2x 4-20mA active or passive (adjustable) (factory adjustment: active 24V/DC), short circuit proof
Digital output		1x relay, NO (Normally Open), potential-free
USB mini socket		Type B
2x PT100 (three-wire system)		-
Ultrasonic sensors		
Type	Pipe size	Temperature
F20 (2 MHz)	DN10-DN100	-40° up to 150°C
F10 (1 MHz)	DN32-DN400	-40° up to 150°C
F05 (500 kHz)	DN200-DN6000	-40° up to 80°C (150°C a.A.)

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